Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Hydrodynamics and Mass Transfer Characteristics of Laminar Bioelectrochemical Systems, a Summary WAY LEE CHENG, REZA SADR, Texas A&M University — Hydrodynamics and diffusion characteristics of laminar bioelectrochemical systems (BES) with common micro-channel configuration are summarized. Computational fluid dynamics (CFD) simulations are performed to supplement literature results and to provide a comprehensive summary for the flow and diffusion characteristics in these systems in terms of dimensionless parameters. The results show that decreasing the fluid velocity enhances mixing between the two parallel flow streams with a stronger mixing in the near wall region. Reducing the ratio of channel width to channel height enhances mixing. Changing the angle between the inlet channels, in general, does not have a strong effect on the flow field, except when the angle is larger than about 135°. Furthermore, fluid mixing is substantially different for 60° and 180° angle between the two inlet channels. For the 60° case, the length of mixing zone does not depends on the Reynolds number and it converges asymptotically as channel width-to-height ratio decreases. On the other hand, for the 180° case, this length depends on the flow Reynolds number and decreases monotonically at small ratio of channel width-to-heights ratio. The results show that asymmetric growth of a bio-layer on the channel wall increases shear stress substantially as one side of the channel as its height reduces compare to the other side. Moreover, this asymmetry causes a traverse velocity field that highly skews the mixing zone towards the side of the channel with larger height.

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Date submitted: 31 Jul 2015 Electronic form version 1.4